

## **ACTION STICKERS FOR IDENTIFYING AND PROCESSING STORED DOCUMENTS**

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### **Background of the Invention**

#### **Cross-Reference to Related Applications**

**[0001]** This application is a continuation-in-part of U.S. Patent Application No. 10/404,916 titled "Method and Apparatus for Composing Multimedia Documents," filed March 31, 2003, the disclosure of which is incorporated by reference.

**[0002]** This application is a continuation-in-part of U.S. Patent Application No. 10/404,927 titled "Multimedia Document Sharing Method and Apparatus," filed March 31, 2003, the disclosure of which is incorporated by reference.

**[0003]** This application is related to the following commonly owned and co-pending U.S. patent applications, the disclosures of which are incorporated by reference:

- U.S. Patent Application No. 09/521,252 titled "Method and System for Information Management to Facilitate the Ex-

change of Ideas During a Collaborative Effort," filed March 8, 2000;

- U.S. Patent Application No. 10/001,895 titled "Paper-Based Interface For Multimedia Information," filed November 19, 2001;
  - U.S. Patent Application No. 10/081,129 titled "Multimedia Visualization & Integration Environment," filed February 21, 2002;
  - U.S. Patent Application No. 10/085,569 titled "A Document Distribution and Storage System," filed February 26, 2002;
  - U.S. Patent Application No. 10/174,522 titled "Television-based Visualization and Navigation Interface," filed June 17, 2002;
  - U.S. Patent Application No.10/175,540 titled "Device For Generating A Multimedia Paper Document," filed June 18, 2002
  - U.S. Patent Application No. 10/307,235 titled "Multimodal Access of Meeting Recordings," filed November 29, 2002;
- and

- U.S. Patent Application No. \_\_\_\_\_ titled "Physical Key for Accessing a Securely Stored Digital Document," filed August 11, 2003.

## **Field of the Invention**

**[0004]** This invention relates generally to document management, and more specifically to techniques of identifying documents in a digitally stored collection and specifying actions to execute on the documents.

## **Background of the Invention**

**[0005]** Despite the ideal of a paperless environment that the popularization of computers had promised, paper continues to dominate the office landscape. Ironically, the computer itself has been a major contributing source of paper proliferation. The computer simplifies the task of document composition, and thus has enabled even greater numbers of publishers. Oftentimes, many copies of a document must be made so that the document can be shared among colleagues, thus generating even more paper.

**[0006]** Despite advances in technology, practical substitutes for paper remain to be developed. Computer displays, PDAs (personal digital assistants), wireless devices, and the like all have their various advantages, but they lack the simplicity, reliability, portability, relative permanence, universality, and familiar-

ity of paper. In many situations, paper remains the simplest and most effective way to store and distribute information.

**[0007]** The conveniences and advantages that paper offers signal that its complete replacement is not likely to occur soon, if ever. Perhaps then, the role of the computer is not to achieve a paperless society. Instead, the role of the computer may be as a tool to move effortlessly between paper and electronic representations and maintain connections between the paper and the electronic media with which it was created.

**[0008]** Related, commonly owned applications for "Method and Apparatus for Composing Multimedia Documents," and "Multimedia Document Sharing Method and Apparatus," the disclosures of which are incorporated herein by reference, describe techniques for organizing multimedia documents into one or more collections. A collection coversheet, or document index, representative of the collection can be printed on a suitable medium, such as paper. This coversheet can provide access to the collection by using a multi-function peripheral (MFP). In this way, individuals can share multimedia documents in the collection by distributing copies of the coversheet to recipients.

**[0009]** Most prior methods to interact with digitally stored documents require the user to enter commands by typing or pressing buttons on hardware or selecting options from displayed menus on the MFP or on a computer. These systems require the user to interact with the hardware and/or navigate menu

options and other user interface features on a display device. Some existing paper-based systems require specialized coversheets to provide processing instructions. For example, a coversheet may be used at the beginning of the print job to specify the number of copies, the size of the paper, etc. These systems require a supply of these coversheets to be kept on hand, and usually require the user to take the time to customize the sheet by filling in the details of the job.

**[0010]** In published European Patent Application No. 99308879.8, "Document Processing," filed November 8, 1999, inventors Klotz et al. disclose a technique of applying a sticker to a hardcopy document to specify a service to perform on that document. When the sticker is scanned, the requested service is identified and performed on the document. Such a system does not provide a technique for specifying actions to be performed on stored documents. Furthermore, a disadvantage of such a system is that the sticker may obscure a portion of the original document; also, since the document is scanned at the same time as the sticker is scanned, the image of the sticker is present on subsequent copies of the document. Moreover, according to the described techniques in Klotz et al., stickers only provide instructions for processing the document to which they are attached.

**[0011]** What is needed is a system and method for providing instructions for processing documents without requiring users to interact with a user interface or hardware device. What is further needed is a system and method that al-

lows users to employ stickers to specify document processing actions for stored documents, including for documents other than the document to which the stickers are attached. What is further needed is a system and method that avoids the limitations of prior art schemes for providing instructions for processing stored documents.

## **Summary of the Invention**

**[0012]** According to the present invention, a user affixes one or more action stickers onto a collection coversheet, document index, or other identifier sheet, in order to specify actions to be performed on a stored document. The action sticker, together with other information on the identifier sheet, indicate to an MFP: a) a desired action; and b) the document on which the action should be performed. Various types of action stickers are available, indicating different types of actions. Examples include but are not limited to: printing, e-mailing, faxing, or deleting documents; grouping documents within the collection; modifying the collection; modifying the organization or hierarchy of documents within the collection; playing audio or video files; and specifying access levels to documents or collections.

**[0013]** In one aspect of the invention, the user selects the type of action sticker appropriate for the desired action and places the selected action sticker on a collection coversheet that identifies a collection. The collection coversheet may

include document thumbnails (or some other indicator of documents within the collection). The user identifies a particular target document for the desired action by placing the sticker at a location that overlaps, is adjacent to, or points to the thumbnail of the document. Thus, the action sticker specifies what action to take, and the location and/or orientation of the sticker specifies the target document.

**[0014]** Action stickers can be self-adhesive. In one aspect, they employ an adhesive similar to that commonly found in removable office notes, and therefore are removable, repositionable, and reusable. Using removable self-adhesive action stickers to communicate instructions to an MFP has several advantages. In particular, they are inexpensive, convenient, compact, easy to produce, familiar to users, and they do not permanently mar the coversheet.

**[0015]** According to other aspects of the invention, multiple stickers may be placed on a coversheet at the same time. For example, "group" action stickers can be placed on the coversheet on, closest to, or pointing to several documents in the collection. The MFP interprets the group action stickers as an instruction to combine the indicated documents into a sub-collection within the original collection. If stickers are of different kinds, a priority of processes determines the order in which processes are completed. For example, if both a print action sticker and a delete action sticker are present for the same document, the MFP applies processing logic to perform the print action before the delete action.

**[0016]** Alternatively, MFP can detect handwritten notations on a coversheet, specifying desired actions and pointing to document thumbnails. However, it has been found that action stickers are easier to detect and read than are handwritten notations, since action stickers can be designed to have distinctive color, shape, and/or markings. Furthermore, it is generally quicker and more convenient to apply an action sticker than to write a notation. Action stickers can easily be removed so that the coversheet is not damaged or defaced; handwritten notations may be less easy to remove.

**[0017]** Further features of the invention, its nature and various advantages will be more apparent from the accompanying drawings and the following detailed description.

### **Brief Description of the Drawings**

**[0018]** The accompanying drawings illustrate several embodiments of the invention and, together with the description, serve to explain the principles of the invention.

**[0019]** Fig. 1 is a block diagram depicting a functional architecture of a system for reading action stickers and performing actions on stored documents responsive to the action stickers, according to one embodiment of the present invention.

**[0020]** Fig. 2 is a flow diagram depicting a method of reading action stickers and performing actions on stored documents responsive to the action stickers, according to one embodiment of the present invention.

**[0021]** Fig. 3A is an example depicting an action sticker affixed to a cover-sheet of a collection, according to one embodiment of the present invention.

**[0022]** Fig. 3B is an example depicting several action stickers applied to a coversheet of a collection, according to one embodiment of the present invention.

### **Detailed Description of the Embodiments**

**[0023]** The present invention is now described more fully with reference to the accompanying Figures, in which several embodiments of the invention are shown. The present invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather these embodiments are provided so that this disclosure will be complete and will fully convey the invention to those skilled in the art.

**[0024]** In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the invention. It will be apparent, however, to one skilled in the art that the invention can be practiced without these specific details. In other instances, structures and devices are shown in block diagram form in order to avoid obscuring the invention.

**[0025]** Reference in the specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

**[0026]** Some portions of the detailed description that follows are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

**[0027]** It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussion, it is appreciated that

throughout the description, discussions utilizing terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

**[0028]** The present invention also relates to an apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general-purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions, and each coupled to a computer system bus.

**[0029]** The algorithms and modules presented herein are not inherently related to any particular computer or other apparatus. Various general-purpose systems may be used with programs in accordance with the teachings herein, or

it may prove convenient to construct more specialized apparatuses to perform the required method steps. The required structure for a variety of these systems will appear from the description below. In addition, the present invention is not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the invention as described herein. Furthermore, as will be apparent to one of ordinary skill in the relevant art, the modules, features, attributes, methodologies, and other aspects of the invention can be implemented as software, hardware, firmware or any combination of the three. Of course, wherever a component of the present invention is implemented as software, the component can be implemented as a standalone program, as part of a larger program, as a plurality of separate programs, as a statically or dynamically linked library, as a kernel loadable module, as a device driver, and/or in every and any other way known now or in the future to those of skill in the art of computer programming. Additionally, the present invention is in no way limited to implementation in any specific operating system or environment.

**[0030]** In this application, the following terms are used:

**[0031]** "Document" refers to any collection of information capable of being stored electronically, including but not limited to text, word processing and spreadsheet files, e-mail messages, voice and audio recordings, images, and video recordings.

**[0032]** “Identifier sheet” refers to a piece of paper or other readable media item that identifies a stored document or collection of documents. As described in above-referenced related patent applications, the identifier sheet may be a collection coversheet or may take on any other form. In one embodiment, the identifier sheet includes a document identifier and/or collection identifier that may be computer-readable, human-readable, or any combination thereof. Identifier sheets are also referred to herein as “document indexes.”

**[0033]** One type of identifier sheet is a “collection coversheet.” A collection coversheet identifies a collection and also includes representations of documents within the collection. In one embodiment, a collection coversheet includes:

**[0034]** - A collection identifier in machine-readable form (such as a barcode) and/or human-readable form (such as a Uniform Resource Locator (URL) or other text string). The collection identifier provides information describing a location of the collection, such as a directory or folder containing documents in the collection.

**[0035]** - A collection overview, which represents documents in the collection by thumbnails. Thumbnails are associated with positions in the overview. For instance, the thumbnail for document A might be in the upper left corner of the collection overview, and the thumbnail for document B might be in the lower right corner.

**[0036]** Further description of collection coversheets, collection identifiers, and collection overviews can be found in related patent applications referenced above and incorporated herein by reference.

**[0037]** For illustrative purposes, the following description sets forth the invention in terms of action stickers on collection coversheets. However, one skilled in the art will recognize that the invention can also be implemented using action stickers on other types of identifier sheets, document indexes, or media items that identify stored documents, and that such implementations would not depart from the essential characteristics of the present invention.

**[0038]** Referring now to Fig. 3A, there is shown an example of an action sticker 103A affixed to a collection coversheet 101, according to one embodiment of the present invention. In one embodiment, collection coversheet 101 is a piece of paper that includes machine-readable collection identifier 102 and collection overview area 501 containing thumbnail representations 503A-F of digital documents (though other representation of documents can be used in lieu of thumbnails 503A-F, such as for example a simple text list of documents). Also included is annotation area 502, where notes may be written, as described in related cross-referenced applications. The particular layout and components shown in Fig. 3A are merely exemplary.

**[0039]** In the example of Fig. 3A, a print action sticker 103A has been affixed to coversheet 101. It overlaps and points toward thumbnail representation 503A, which refers to one of the documents in the collection associated with coversheet 101. In general, action stickers 103 may be placed in any orientation in overview area 501. The system of the present invention is capable of recognizing action stickers 103 regardless of their orientations.

**[0040]** In one embodiment, action stickers 103 are removable, reusable, and recyclable. They may employ a weak adhesive similar to that found in commonly used removable office notes such as Post-It® Notes available from 3M Company of St. Paul, Minnesota. One benefit of removable action stickers is that collection coversheet 101 is not permanently marred or ruined by the application of action stickers 103; thus, the user need not reprint new copies of coversheet 101 to execute each document processing request. Reusable action stickers 103 reduce the amount of waste generated by the invention, and reduce the cost to the consumer of implementing the invention. Making action stickers out of recyclable material allows for a coversheet with stickers to be recycled according to conventional recycling methods, without having to separate the stickers from the coversheet 101. One skilled in the art will recognize, however, that the invention can be implemented using action stickers 103 having other forms and characteristics; for example, non-removable and/or non-recyclable action stickers 103 may be used without departing from the essential characteristics of the invention.

**[0041]** Action sticker 103A as shown in Fig. 3A is arrow-shaped and includes a word indicating the desired action ("Print"). Other formats and shapes are possible and will be recognized by one skilled in the art in light of this description. For example, an action sticker 103 may specify an action based on its shape and/or color, or on its orientation or position as placed on coversheet 101, or on a symbol, icon, letter, word, or machine-readable code printed on sticker 103. In one embodiment, the action sticker 103 is machine-readable, so that the shape, color, word, icon, symbol, letter, word, or code is understandable by a machine.

**[0042]** One particular example is an action sticker 103 in the shape of a small "L" that can be used to identify a group of one or more documents on which an action is to be performed. Two stickers 103 can be affixed to delimit the group of documents, by placing a first sticker 103 at the top left corner of the thumbnail of the first document to be processed and a second sticker 103 at the bottom right corner of the thumbnail of the last document in the group. In one embodiment, such an arrangement would signal to the MFP of the present invention that the requested action should be performed those documents that correspond to thumbnails located between the action stickers 103. Other formats for action stickers 103, such as dots, brackets, and rectangles may also be used without departing from the principles of the invention.

**[0043]** In one embodiment, action stickers 103 are of relatively small size as compared to overview area 501, so as to facilitate more accurate interpretations of which document is the intended target based on the placement of the action sticker 103. If an action sticker 103 is placed such that it overlaps more than one thumbnail 503, for example, there is potential ambiguity as to which document should be processed. As will be described in more detail below, the MFP of the present invention can employ any of a number of techniques to resolve such ambiguity. At any rate, an action sticker 103 of relatively small size is less likely to overlap two or more thumbnails.

**[0044]** Referring now to Fig. 3B, there is shown an example wherein multiple action stickers 103B-D have been affixed to collection coversheet 101, according to one embodiment of the present invention. "Group" action stickers 103B-D are shown by way of example. Group action stickers 103B-D identify particular documents (in this case, those documents corresponding to thumbnails 503A, 503F, and 503E), that the user wishes to group together as a sub-collection within the original collection represented by coversheet 101. MFP interprets stickers 103B-D and performs the grouping operation as requested. In one embodiment, grouping and sub-collection organization is implemented as described in related cross-referenced patent applications that have been incorporated herein by reference.

**[0045]** Referring now to Fig. 1, there is shown a block diagram depicting a functional architecture of a system for reading action stickers and performing actions on stored documents responsive to the action stickers, according to one embodiment of the present invention. Referring also to Fig. 2, there is shown a flow diagram depicting a method of reading action stickers and performing actions on stored documents responsive to the action stickers, according to one embodiment of the present invention. The method may be performed, for example, by the system depicted in Fig. 1, or by other functional components and systems. The order of the steps in the described embodiment is merely exemplary. One skilled in the art will recognize that the steps can be performed in an order other than what is depicted.

**[0046]** The invention is described herein in the context of a multifunction peripheral (MFP) 100 including scanner 104, a machine-readable code locator and reader 106, an action sticker locator and reader 107, a document identifier and processor 113, and printer 115. Action sticker locator and reader 107 may also include functionality for locating collection overview area 501 within collection coversheet 101; alternatively, such functionality may be provided in a separate component (not shown). MFP 100 may also contain other components, some of which may not be required for the operation of this invention. MFP 100 may contain a network interface card (not shown), which can receive processing requests from the external network, a fax interface, media capture devices, a media

capture port, and the like. Control interface 117 provides a mechanism by which the user can initiate, configure, monitor, and/or terminate MFP 100 operations, for example, to make copies, scan documents, and print faxes. In one embodiment, interface 117 includes a keypad, display, touchscreen, or any combination thereof.

**[0047]** The components shown in MFP 100 are functional components that may be implemented using any combination of hardware elements, software, or the like. For example, the functionality of reader 106 and reader 107 may be implemented within a single hardware component and/or software module, or they may be broken out into separate functional components. Accordingly, the architecture shown in Fig. 1 is intended to illustrate the overall functionality of the invention according to one embodiment, and is not intended to limit the scope of the claimed invention to any particular set of components.

**[0048]** In one embodiment, MFP 100 can access other forms of media through electronic data input peripherals (not shown) including, for example, magnetic media readers for magnetic media such as floppy disks, magnetic tape, fixed hard disks, removable hard disks, memory cards, and the like. Peripherals may also include optical media readers (not shown) for optical storage media such as CDs, DVDs, magneto-optical disks, and the like. In addition, in one embodiment MFP 100 is communicatively coupled to storage device 109, which may be a hard drive or other device capable of storing collections of digital docu-

ments, for example in database form. Storage device 109 may be at the same location as MFP 100, or it may be remotely located, connected for example via a network.

**[0049]** As described above in connection with Figs. 3A and 3B, collection coversheet 101 includes machine-readable collection identifier 102 and collection overview area 501 containing thumbnail representations 503 of digital documents. Action sticker 103 is affixed to coversheet 101 in such a way that it points to thumbnail 503, thus identifying a particular document as the target for the specified action.

**[0050]** MFP 100 receives 201 an image 105 of coversheet 101, for example by scanning coversheet 101 using scanner 104 according to techniques that are well known in the art. Alternatively, MFP 100 may use other input mechanisms known to persons of ordinary skill in the art to receive 201 the image of coversheet 101. For example, MFP 100 may receive the image via e-mail, fax, retrieval from previously stored coversheet 101 images, or the like.

**[0051]** MFP 100 then locates 202 collection identifier 102 within image 105 of coversheet 101, and reads 203 the identifier 102. In one embodiment, steps 202 and 203 are performed by passing image 105 to machine-readable code locator and reader 106, which locates and reads collection identifier 102. Collection identifier 102 identifies the storage location of documents in the collection. In one embodiment, identifier 102 is a URL or the like that identifies documents by loca-

tion and filename. For example, identifier 102 may identify documents within storage device 109. In one embodiment, identifier 102 also identifies a map that associates documents with particular regions within collection overview 501.

**[0052]** Code locator and reader 106 passes the read collection identifier 102 to document identifier and processor 113 as described in more detail below.

**[0053]** MFP 100 locates 204 collection overview 501 within image 105 of coversheet 101, for example by determining the overall size and shape of overview 501. In one embodiment, overview 501 is provided at a standard location within coversheet 101, or is color coded or otherwise marked, so as to facilitate easier identification of overview 501. Alternatively, overview 501 can be at an arbitrary location and have arbitrary characteristics. In one embodiment, action sticker locator and reader 107 component of MFP 100 performs step 204; in another embodiment, another component (not shown) of MFP 100 performs this step.

**[0054]** MFP 100 locates 205 action sticker(s) 103 that have been affixed to collection overview 105. In one embodiment, action sticker locator and reader 107 component of MFP 100 performs step 205. Step 205 may be performed in response to the user specifying, via control interface 117, that one or more action sticker(s) 103 are present. Alternatively, reader 107 may be configured to automatically attempt to locate action sticker(s) 103 whenever a coversheet 101 has been scanned by scanner 104.

**[0055]** In some embodiments action stickers are recognizable in some way to action sticker locator and reader 107, such as by being a unique color, containing a barcode, having a specific and recognizable shape, or by some other visual characteristic. Alternative methods for locating objects in an image are known the art or have been described in related co-pending applications.

**[0056]** Based on visual characteristic of action sticker(s) 103, action sticker locator and reader 107 identifies 206 the desired action(s). In one embodiment, stickers 103 corresponding to a particular action are visually similar in some respect, for example having the same color or having the same word printed on them. Conversely, stickers 103 corresponding to different actions may be visually dissimilar in some respect, for example by being different colors or having a different word printed on them. In one embodiment, action sticker locator and reader 107 passes the action request 112 to document identifier and processor 113.

**[0057]** MFP 101 also determines, based on the location of action sticker(s) 103, the desired target document(s) for each action. In one embodiment, this determination is made by a) determining an action point for each action sticker 103, and b) determining which thumbnail 503 is located at, or closest to, the action point. In one embodiment, action sticker locator and reader 107 determines action points for each sticker 103, and document identifier and processor 113 de-

termines a target document by comparing the location of action points with known information about thumbnail 503 locations in overview 501.

**[0058]** The action point for a sticker 103 can be the tip of an arrow, or the center of a target, or some other location on the sticker 103 that indicates a target document. In one embodiment, action sticker locator and reader 107 passes sticker location information 111 to document identifier and processor 113; this sticker location information 111 can include action point coordinates. If action sticker locator and reader 107 determines that the action point for a sticker is outside collection overview area 501, in one embodiment it ignores the sticker 103 and does not pass the information 111 to document identifier and processor 113. In another embodiment, it still passes the information 111, so that document identifier and processor 113 can attempt a best estimate as to the target document.

**[0059]** In one embodiment, storage device 109 includes a map 110 corresponding to each collection; the map provides coordinates for thumbnails 503 within overview 501. Thus, two-dimensional coordinates within overview 501 identify (or map to) documents, based on the locations of thumbnails 503 for those documents. In one embodiment, the map is implemented as a list of rectangles, one representing the entire collection overview 501, and other rectangles representing positions of document thumbnails 503 within the overview 501. Map 110 may be stored as a separate file, such as a Scalable Vector Graphics

(SVG) file containing a description of collection overview 501 with identifiers that associate regions within the overview 501 with documents in the collection.

Alternatively, map 110 may be stored as part of collection information 301.

**[0060]** Document identifier and processor 113 uses collection identifier 102 (obtained from code locator and reader 106) to retrieve, from storage 109, map 110 indicating the correspondence of coordinates within collection overview 501 to collection documents. Based on the map and based on sticker location information 111, document identifier and processor 113 determines a target document. If an action point falls within a rectangle representing a document thumbnail 503, the corresponding document is deemed to be the target of the action. If the action point falls within the rectangles of more than one thumbnail 503 (in an implementation where document thumbnails 503 can overlap), the action can be performed on both documents, or just the topmost document or the first document. Alternatively, in such a situation where ambiguity exists as to which document is the target document, MFP 101 can do any of the following: designate as the target the document corresponding to the closest thumbnail 503 to the action point; determine which document is most likely the intended target based on the type of action being performed and the type of document; determine which document is most likely the intended target based on historical usage; display an error message; and/or prompt the user, via control interface 117, to specify which document is intended to be the target. Similarly, if an action point

falls between rectangles of thumbnails 503, document identifier and processor 113 can determine the intended target based on: a) which thumbnail 503 is closest to the action point; b) which thumbnail 503 is pointed to by the action sticker 113; c) which document is best suited for the particular action; d) historical usage; or e) additional information from the user, provided in response to a prompt via control interface 117.

**[0061]** If sticker 103 is arrow-shaped, document identifier and processor 113 is configured to recognize that the likely intended target document is the one that is pointed to by the arrow. Thus, in situations where the action point of sticker 103 falls between rectangles, document identifier and processor 113 (or action sticker locator and reader 107) determines which way the arrow is pointing, so as to more accurately determine the target document.

**[0062]** In one embodiment, coordinates for the action point and overall coordinates for the collection overview 501 are normalized. Thus, coordinates of the action point are converted from a location on coversheet 101 to a location within the overview 501.

**[0063]** In one embodiment, steps 205 and 206 are performed using known techniques of optical feature recognition.

**[0064]** If more than one action sticker 103 is found, document identifier and processor 113 sorts 207 the actions in an appropriate order. For example, if stickers 103 for a particular target document indicate that the document should be

both printed and deleted, the print action should take place before the delete action. In one embodiment, the default sort order is as follows: print, e-mail, fax, group, ungroup, delete. Alternatively, MFP 100 may alert the user to the presence of multiple actions on a document and request clarification (via control interface 117, for example) as to the intended order to carry out the actions.

**[0065]** If a specified action involves transmitting the document, for example by e-mail or fax, MFP 100 locates the correct routing information (such as an e-mail address or a fax number) indicating the desired destination for the document. Routing information can be included on or written on sticker 103, or written in annotation area 502 of coversheet 101, so that it can be extracted via optical character recognition (OCR). For example, if a single e-mail address is written in annotation area 502, all documents to be e-mailed can be sent to that e-mail address. Alternatively, MFP 100 can prompt the user to enter routing information via control interface 117. Alternatively, the routing information could be written on a second sheet of paper to be scanned or in a second image received by MFP 100. In any of these embodiments, the operation of determining routing information can be performed by action sticker locator and reader 107, or by document identifier and processor 113, or by another component of MFP 100.

**[0066]** Once actions and target document(s) have been determined, document identifier and processor 113 uses collection identifier 102 (obtained from code locator and reader 106) to retrieve 208, from storage 109, the target docu-

ment(s) 114 and performs 209 the specified action(s) in the determined order.

For some actions (such as delete), retrieval of the document(s) 114 is not required, and step 208 is not performed. In one embodiment, document identifier and processor 113 first retrieves collection information 301 which includes or points to target document(s) 114, and then obtains target document(s) 114 accordingly.

**[0067]** Examples of stickers 103 and their corresponding actions include:

**[0068]** *Print sticker:* Document identifier and processor 113 sends target document(s) 114 to printer 115. Printer 115 outputs printed document 116.

**[0069]** *E-mail or fax sticker:* Document identifier and processor 113 sends the documents to an e-mail or fax module (not shown) of MFP 100 to be transmitted accordingly.

**[0070]** *Group sticker:* Document identifier and processor 113 creates a new sub-collection including the target documents, deletes the target documents from the original collection, and adds the new sub-collection to the original collection. In one embodiment, all of the documents pointed to by “group” stickers 103 are placed into the same new sub-collection; alternatively, different types of group stickers 103 (color-coded or otherwise distinguishable from one another) can be used, so that a new sub-collection is created for each type of group sticker 103.

**[0071]**     *Ungroup sticker (on an existing sub-collection):* Documents within the sub-collection are retrieved and placed in the overall collection corresponding to coversheet 101.

**[0072]**     *Delete sticker:* Document identifier and processor 113 deletes the specified document(s) or sub-collection(s). In one embodiment, a confirmation dialog box is presented on control interface 117 before the delete operation is performed.

**[0073]**     *Play sticker:* Document identifier and processor 113 sends target document(s) 114 (such as audio and/or video files) to an output device to be played.

**[0074]**     Document identifier and processor 113 determines 210 whether any of the performed actions cause changes to collection map 110 and overview 501. If so, document identifier and processor 113 modifies 211 collection map 110 and overview 501 accordingly to indicate locations of thumbnails 503 corresponding to new documents and sub-collections and to delete thumbnails 503 for documents and sub-collections that have been removed. The updated collection info 301, map 110, and/or overview 501 are stored in storage device 109. Optionally, the updated collection information 301 and map 110 are sent to coversheet generator 302 for generation of an updated coversheet 101A including a new overview 501, as described below.

**[0075]** When documents are moved from one collection to another, a default layout can be used for the arrangement of thumbnails 503. Alternatively, the user may be given an opportunity to indicate a layout. Such techniques are described in related cross-referenced patent applications.

**[0076]** Printer 115 may optionally (or automatically) print 212 a new collection coversheet 306 representing the collection, particularly if collection organization has been modified, or if nonremovable stickers 103 have been used.

**[0077]** For example, a print action sticker 103 can be used to request printing of a document in the collection by placing print action sticker 103 on coversheet 101. Machine-readable code locator and reader 106 reads the collection identifier 102. Action sticker locator and reader 107 locates and reads the print action sticker 103, passing sticker location information 111 and a print action request 112 to document identifier and processor 113. Document identifier and processor 113 identifies the target document based on the sticker location information 111 and on map 110 retrieved from storage 109. Document identifier and processor 113 retrieves document 114 from storage and passes it to printer 115. Printer 115 outputs printed document 116.

**[0078]** In one embodiment, when collection organization is modified (such as by changing hierarchy, layout, or access levels), a new version or layer of the collection is added. Thus, rather than overwriting the collection with new information, an updated version of the collection is generated and stored in a new

location within storage 109, and a new collection identifier 102 is generated that points to the new location. A new coversheet 101A is printed with the new collection identifier 102. In this manner, previous versions of collections are preserved.

**[0079]** For example, when a document is deleted, a new collection is created which is exactly like the original collection except that it omits the deleted document. Map 110 and overview 501 are altered to reflect that the document has been deleted. The new collection can be either a new layer of the original collection or it can be a completely new collection unrelated to the original except that it was derived from the original. Such versioning and layering techniques are described in detail in related cross-referenced applications.

**[0080]** In one embodiment, MFP 100 includes coversheet generator 302, either as a separate functional module or as a component of document identifier and processor 113 or some other component. Coversheet generator 302 is therefore an optional component that need not be included, and indeed is absent in some embodiments. When included, coversheet generator 302 performs step 211 to receive updated collection info 301A from document identifier and processor 113, modify collection map 110, and generate an updated coversheet 101A to be sent to printer 115 to be output as printed coversheet 306.

**[0081]** In some embodiments, the present invention includes the following additional features and functionality. Any of these features may be included alone or in combination with one another and/or in combination with the above-described features and components.

**[0082]** *Permission Level Action Stickers.* In one embodiment, action stickers 103 are used to specify or modify access permission levels to documents and/or to create a collection with limited access permissions for documents in the collection. Upon detecting such an action sticker 103, MFP 100 modifies access permission levels according to techniques that are described in related cross-referenced patent applications.

**[0083]** *Action Stickers as Physical Access Keys.* In one embodiment, action stickers 103 contain machine-readable codes containing keys to decrypt encrypted documents stored in collections. Thus, the action sticker 103 functions as a physical access key as described in related cross-referenced application No. titled "Physical Key for Accessing a Securely Stored Digital Document," filed August 11, 2003 and incorporated herein by reference. By its placement on cover-sheet 101, the action sticker 103 identifies which document or collection should be decrypted using the decryption key imprinted on the action sticker 103.

**[0084]** *Generic Action Stickers.* According to another embodiment, generic action stickers can be applied to collection coversheets 101. Generic action stickers are identifiable by some visual characteristic as being an action sticker 103,

but one without a particular action. For example, one format for generic action stickers is to be the same size and shape as other action stickers 103, but without any words printed on them. By its placement on coversheet 101, a generic action sticker identifies one or more target document(s) but does not identify an action to be performed. The user is prompted, for example via control interface 117, to specify a desired action to be performed on the target document(s).